Volume 3 Article 9

4-1-1976

Research Notes: Genetic Studies of Soybean Host Cultivar Interactions with Rhizobium Strains

T. E. Devine
United States Department of Agriculture

Copies of cultivar descriptions and results are available from the Harrow Research Station, and seeds of the 15 cultivars grown in 1974 are available from The Plant Gene Resources of Canada.

R. I. Buzzell, B. R. Buttery and L. J. Anderson
Agriculture Canada

D. A. Littlejohns
Ridgetown College of Agricultural Technology

J. G. R. Loiselle
The Plant Gene Resources of Canada

BELTSVILLE AGRICULTURAL RESEARCH CENTER
Cell Culture and Nitrogen Fixation Laboratory
Beltsville, Maryland

1) Genetic studies of soybean host cultivar interactions with Rhizobium strains.

Several genetic factors have been identified which govern specific nodulation response in soybeans. The Rj_2 genotype, carried by the cultivars 'Hardee' and 'CNS,' conditions an ineffective response in specific combination with *Rhizobium japonicum* strains of serogroups cl and 122. The ineffective response is characterized as the development of either cortical proliferations on the roots or rudimentary nodules, rather than normal nodules. The Rj_3 genotype, carried by the cultivar Hardee, conditions an ineffective response in combination with strain 33; and the Rj_4 genotype, carried by the cultivars 'Hill,' 'Dunfield,' and 'Dare,' conditions an ineffective response with strain 61.

In monitoring the presence of these genes in the germplasm now used in the production of soybeans in the U.S., the cultivars in Table 1 were tested, by the leonard jar technique, against *Rhizobium* strains defining for the presence of several *Rj* factors: strain 7 (of serogroup cl) for Rj_2, strain 33 for Rj_3, strain 61 for Rj_4. Strain 123 was included because of its aberrant reaction with the cultivar 'Peking.' Strain 110 was included as a check.

The results indicate that the cultivars 'Lee' and 'Davis' exhibit the Rj_3 phenotype. Both Lee and Davis have pedigrees which involve CNS. In other tests we have found that CNS also carries the Rj_3 gene as well as Rj_2. In this test 'Amsoy 71' exhibits the Rj_4 phenotype. 'Tracy' is heterogeneous for the $\underline{Rj_4}$ phenotype, with some plants nodulated normally and others displaying the ineffective response. The pedigree of Amsoy 71 involves Dunfield, the putative source of the $\underline{Rj_4}$ gene. The pedigree of Tracy involves Hill as the putative source of the $\underline{Rj_4}$ gene.

Cultivars	Maturity group	Rhizobium strains 7	33	61	110	123	Uninoculated check
Hodgson	I	NOD	NOD	NOD	NOD	NOD	Not nodulated
Amsoy 71	II	NOD	NOD	Ineffective	NOD	NOD	Not nodulated
Corsoy	II	NOD	NOD	NOD	NOD	NOD	Not nodulated
Williams	III	NOD	NOD	NOD	NOD	NOD	Not nodulated
Bonus	IV	NOD	NOD	NOD	NOD	NOD	Not nodulated
Forrest	V	NOD	NOD	NOD	NOD	NOD	Not nodulated
Tracy	VI	NOD	NOD	Ineffective[a]	NOD	NOD	Not nodulated
Lee	VI	NOD	Ineffective	NOD	NOD	NOD	Not nodulated
Davis	VI	NOD	Ineffective	NOD	NOD	NOD	Not nodulated
Bragg	VII	NOD	NOD	NOD	NOD	NOD	Not nodulated

NOD = normal nodulation.
Ineffective = Cortical proliferations or rudimentary nodules rather than normal nodules are formed on the roots.
a = Heterogeneous population.

References

Caldwell, B. E. 1966. Inheritance of a strain-specific ineffective nodulation in soybeans. Crop Sci. 6: 427-428.

Vest, Grant. 1970. $\underline{Rj_3}$-a gene conditioning ineffectiveness in soybeans. Crop Sci. 10: 34-35.

Vest, Grant and B. E. Caldwell. 1972. $\underline{Rj_4}$-a gene conditioning ineffective nodulation in soybean. Crop Sci. 12: 692-694.

Vest, Grant, D. F. Weber and C. Sloger. 1972. Nodulation and nitrogen fixation. In B. E. Caldwell (ed.). Soybeans: Improvement, production, and uses. Am. Soc. Agron., Madison, Wisconsin. pp. 353-390.

T. E. Devine—USDA

2) Vegetative propagation of soybeans.

During the course of genetic studies of possible linkage associations involving factors controlling nodulation response in soybeans, we found it desirable to increase the size of the F_2 population produced in the greenhouse during the winter. We endeavored to do this by vegetatively propagating the F_1 hybrid plants for use in seed production. We visualize that vegetative propagation would also be useful for other purposes: (1) maintaining aneuploids which segregate at meiosis, and (2) providing propagules which may be subjected to different photoperiod regimes, thus providing coincidence of flowering in crosses of uncertain maturity when little seed is available. In a search of recent publications, we have been unable to find a technique describing procedures for vegetative propagation of soybeans. We tested the following procedure for rooting of cuttings.

Greenhouse plants of the cultivar 'Clark' were used as stock material for cuttings. The cuttings, 8 to 10 cm long with two or three nodes, were taken from the mid-section of 75-day old plants. Smooth clean cuts were made with a scalpel 0.5 cm below the lower node. One trifoliate leaf remained on the upper node of the cutting. No root promoting compounds were applied.

Two rooting media were used, coarse perlite and vermiculite. The media were held in a wooden flat 35 x 50 x 10 cm and placed under a continuous fine mist. Cuttings were implanted in the medium to a depth of 7 to 9 cm (internode length) leaving a trifoliate and a portion of the stem uncovered. Twenty-one days after implanting, the cuttings were removed from the media.

Both media provided satisfactory rooting. Fifty-two cuttings of the 56 attempted (94%) developed a root system. The roots of the cuttings in perlite were thicker and more numerous with more lateral roots than the cuttings in vermiculite. Cuttings in vermiculite were finer and longer than those in perlite. Roots originated at both the node and internodal regions, above and below the basal node. However, roots developed most profusely at the node. Seventy-five percent of the cuttings rooted exclusively at the nodal area. The remaining 25% rooted along the internode as well as at the node. No prominent callus tissue or swelling was observed.

J. S. Plaskowitz
T. E. Devine —USDA